Critical Assessment of Wildlife Predation Issues and Management Strategies for Feral Cats in the Cayman Islands

Felis catus (domestic cat) was first domesticated in North Africa and Europe from wild cats a long time ago. There is no date for the species introduction In the Americas and the Cayman Islands, but it is safe to conclude that domestic cats came over many decades during the colonial period. Roaming and abandonment of cats, along with their high reproductive ability, has led to the establishment of feral populations across the Americas including in all three Cayman Islands. As proliferating, alien predators, feral cats are an invasive species. Their predatory behaviour has contributed to the extinction of 33 species worldwide and they continue to threaten other species already classed as critically endangered (Medina et al., 2011).

Islands habitually have vulnerable populations of wildlife by effect of their isolation and small land mass. The isolation leads to high rates of endemism and small size restricts the species range and population. Furthermore, a small land mass with small animal populations usually cannot sustain a naturally occurring population of apex predators, or sometimes even mesopredators. Island wildlife therefore has a heightened ease of extinction compared to wildlife populations in larger, continental systems (Spatz et al., 2017). Grand Cayman, Cayman Brac and Little Cayman are no exception to vulnerability to invasive species. Where feral cats are generalist, opportunistic predators that hunt any wildlife possible (Department of Environment & Department of Agriculture, unpublished report, 2018) there are Cayman-specific species that are increasingly vulnerable. These include two endangered endemic species of *Cyclura* iguanas, regionally important breeding colonies of brown boobies (*Sula leucogaster*), internationally important breeding colonies of red-footed boobies (*Sula sula*) and magnificent frigatebirds (*Fregata magnificens*). The iguana species are especially vulnerable at the juvenile stages, with a recent radio tracking study revealing that 2 out of 18 newly-hatched iguanas were predated by cats within two weeks after emerging. A further 10 juvenile iguanas' fates were unable to be determined (Moss et al., 2019). These iguanas were only tracked for a mean of 17 days, leaving much more time for further cat predation as the iguanas are vulnerable for another year to two years of their life. Cat predation of brown boobies is of major concern and at a critical point for needed management. Brown boobies nest on the ground making the whole family unit vulnerable. The chicks have no defence mechanism and the parents remain to try and defend their offspring, but can be overpowered and fatally injured. Monitoring of the nesting brown booby population is undertaken annually by volunteers, coordinated by the Department of Environment (DoE). In 2018, approximately 10% of the brown booby population on Cayman Brac was lost due to cat predation (Department of Environment, unpublished data, 2019). In the Cayman Islands, brown boobies only nest in Cayman Brac with a generally restricted range and rare emigration or immigration with the wider Caribbean population (Austin et al., unpublished report, 2018). Continuation of the same or increased predation rate could see the local extinction of brown boobies in the Cayman Islands within 10 years. All three Cayman Islands were externally listed as priorities for feral cat control by Nogales et al., 2013 due to the vulnerability of present critically endangered species.

With the feral cat population constantly increasing unchecked, management options for control of feral cats is contested. Trap-euthanase has been found to be the most effective control of feral cats in case studies (Ratcliffe et al., 2010; Algar et al., 2001; Algar et al., 2003), population modelling studies (Loyd & DeVore, 2010; Schmidt et al., 2009; Andersen et al., 2004) and literature reviews

(Longcore et al., 2008; Jongman & Karlen, 1996). Euthanasia of healthy animals raises ethical concerns, leading to advocacy for trap-neuter-release (TNR) programs. Supporters have cited certain studies indicating apparent efficacy, although these case studies have been coupled with intensive adoption efforts (Levy et al., 2003). Other cases have seen no net reduction in feral cat populations due to ineffective implementation (Foley et al., 2005), or no net reduction due to immigration or abandonment of cats (Natoli et al., 2006). Population modelling has been able to realise the ultimate aim of TNR, which is to reduce the population of cats by attrition, but only under certain conditions. Generally, the population needs to be quantified and small (Loyd & Devore, 2010 state this as ≤50 individuals) in a closed system with absolutely no immigration, ongoing project maintenance and the ability to sterilise 75-100% of the population (Loyd & DeVore, 2010; Andersen et al., 2004; Jongman & Karlen, 1996). Large adoption efforts and free, or heavily subsidised, sterilisation of companion cats assist these points. Realistically, a completely closed system with TNR is currently impossible or very difficult to attain and results in the continued proliferation of feral cats. Many areas also develop large populations of feral cats before the need for control measures are considered. Other case studies have been clearer in stating failures of TNR programs at reducing the populations of feral cats (Castillo & Clarke, 2003; Letter to The Royal Bermuda Gazette, 2015).

Efficacy of TNR programs aside, the stated aim is to release an invasive predator into a vulnerable ecosystem. Forty-four per cent of well-fed companion cats have already been documented to exhibit hunting activity, which is more than owners previously thought (Loyd et al., 2013). The same study on a "colony" of cats supplied daily with food revealed that 83% of these cats hunted wildlife (Hernandez et al., 2018), concluding that supplemental feeding of feral cats does not inhibit or even significantly reduce predation behaviours. Official guidelines for TNR programs state that "colonies" should **not** be established around ecologically sensitive areas (American Veterinary Medical Association, Canadian Veterinary Medical Association). The Australian Veterinary Association does not condone TNR programs and in some areas it is illegal to release and feed feral cats due to the vulnerability of wildlife (Australian Government Department of Environment, 2015). Given the vulnerability of the Cayman Island ecosystems, the islands' small size, high rates of endemism and no natural predators, "managed colonies" of feral cats should not be entertained given best practise rules of many authoritative or advisory bodies.

Support for TNR stems from ethical considerations for feral cats, although there are further considerations of welfare for both feral cats and wildlife. By releasing a feral cat, it is uncertain if it can be captured again or protected from threats causing premature mortality. Vaccination and medicine courses need to be completed after initial treatment and exposure to harsh conditions will reduce the life expectancy of a feral cat by approximately half, frequently more (Kass et al., 2013). On inspection of 24 cats removed from Little Cayman in 2018, 75% had internal parasites and 95% were under two years of age (Department of Environment, Department of Agriculture, unpublished data, 2018). Many reports from Little Cayman document the range of ailments of feral cats, including lost eyes and broken bones (Letter to Cayman Compass, 2019). Beyond the welfare of the released cats, consideration of the welfare of wildlife is normally not fully considered by proponents of TNR. At the Lindsay Museum of Walnut Creek, USA, 30.3% of bird intakes over 10 months, exclusive of raptorial and pelagic birds, were due to cat-related injuries (Jessup, 2004). Due to innate hunting behaviour of cats, predation behaviour cannot be prevented (Loyd et al. 2013) and so the inevitable killing, injury and disturbance of wildlife should be part of the ethical debate when considering releasing the cause of more patients for veterinarians.

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